# 3.12 Water Resources

This section discusses water resources (i.e., floodplains, quality of surface water and groundwater, hydrology, and hydrogeology) in the project study area. Floodplains are areas that may become inundated by stormwater runoff during storm events. Encroachment by structures or earthmoving activities into such areas can reduce the flood-carrying capacity and increase flood heights and severity of potential flood-related impacts. This section also discusses floodplains in the project study area, as well as floodplain regulations, and provides information about the Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP). The water quality portion of this section presents information on state and federal water quality regulations and required permits, and includes a brief discussion on Utah Department of Transportation (UDOT) de-icing practices.

Information and data from multiple documents were used in preparing the water resources assessment. These included:

- FEMA floodplain delineation data
- Federal Highway Administration's (FHWA's) and U.S. Army Corps of Engineers' (USACE's) *Final Legacy Parkway Supplemental Environmental Impact Statement/Reevaluation and Section 4(f), 6(f) Evaluation* (2005)
- Utah Department of Environmental Quality [UDEQ], Division of Water Quality's:
  - *Jordan River Watershed Beneficial Use Classifications (2000)*
  - *Utah Lake–Jordan River Watershed Management Unit Stream Assessment (2002)*
  - *Utah's 303(d) List of Impaired Waters (Final) (2004)*
  - *Utah 2006 Integrated Report Volume I: 305(b) Assessment (2006a)*
  - *Utah 2006 Integrated Report Volume II - 303(d) List of Waters (2006b)*
- Utah Lake watershed analysis prepared by the Great Salt Lake Hydrologic Observatory (2004)

## *3.12.1 Regulatory Setting*

### 3.12.1.1 Clean Water Act

Water quality is regulated by the federal Clean Water Act (CWA), which was promulgated in 1977. The CWA is the primary federal law that protects the nation's waters, including lakes, rivers, aquifers, and coastal areas. Three sections of the CWA are applicable to the proposed project:

- Section 401 (state water quality certification);
- Section 402 (National Pollutant Discharge Elimination System [NPDES] permits); and
- Section 404 (permit for discharge of dredged or fill material in waters of the United States).

#### *Permits*

The U.S. Environmental Protection Agency (EPA) is the federal agency with regulatory authority for Sections 401 and 402 of the CWA. In July 1987, it delegated portions of this authority to the State of Utah. UDEQ is the governing agency for issues related to water quality, including Section 401 certification and Section 402 NPDES permits. The USACE is the issuing agency for Section 404 permits; Section 404 regulates wetlands, streams, lakes, and other waters of the United States.

Applicants for federal permits for an activity that may result in a discharge of pollutants into a water body must request from UDEQ certification that the proposed activity will not violate state or federal water quality standards. If UDEQ finds that the project is in compliance, then the determination is provided in the form of a Section 401 water quality certification.

Discharge to surface water is regulated through the Utah Pollutant Discharge Elimination System (UPDES) program, which is the state's version of the NPDES program. Construction of the proposed project may include clearing, grading, and excavation activities, which could potentially discharge pollutants to stormwater that ultimately flows into one or more surface waters. Because more than 1 acre would be disturbed, a UPDES permit would be required for the construction phase, including provisions to prevent water quality impacts to stormwater during construction and to prevent stormwater contaminants from entering the permanent drainage system.

Post-construction stormwater runoff from UDOT projects is managed under a statewide individual stormwater permit issued by UDEQ (2003). In compliance with conditions of the permit, UDOT has developed standard construction and post-construction measures to reduce and treat stormwater runoff. UDOT also implements a water quality monitoring program and submits monitoring annual reports to UDEQ.

*Clean Water Act Goals*

The goals of the CWA are to eliminate the discharge of pollutants into the nation's waters and to achieve water quality levels that are fishable and swimmable. These goals are to be achieved by:

- Requiring major industries to meet performance standards to ensure pollution control;
- Charging states and tribes to set specific water quality criteria appropriate for their water and to develop pollution control programs to meet these criteria, and
- Regulating the discharge of dredge or fill material into waters of the United States.

### 3.12.1.2 Section 303(d) and the Utah Water Quality Act

Under CWA Section 303(d) and the Utah Water Quality Act (Utah Department of Environmental Quality 2007), the State of Utah is required to establish beneficial uses of state waters and to adopt water quality standards to protect those beneficial uses. Section 303(d) establishes the Total Maximum Daily Load (TMDL) process to assist in guiding the application of state water quality standards, requiring the states to identify streams whose water quality is "impaired" (e.g., affected by the presence of pollutants or contaminants) and to establish the TMDL (e.g., the maximum quantity of a particular contaminant that a water body can assimilate without experiencing adverse effects).

Utah has classified surface waters in the state into Beneficial Use Classifications, as described in Table 3.12-1, *UDEQ Beneficial Use Classifications*, on the following page. Each classification has an associated numerical or narrative standard. The numeric standards consist of limits on concentrations of chemicals and other constituents, in addition to water temperature limitations. The narrative standard is:

> It shall be unlawful, and a violation of these regulations, for any person to discharge or place any waste or other substance in such a way as would be or may become offensive such as unnatural deposits, floating debris, oil, scum, or other nuisances such as color, odor, or taste; cause conditions which produce undesirable aquatic life or which produce objectionable taste in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures (Utah Administrative Code, Rule R317-2-7).

The quality of surface waters should meet or exceed the established standards to be safe for their intended uses. UDEQ gives additional protection to maintain the integrity of those waters defined as "high quality waters"; however, there are no designated "high quality waters" in the study area.

Other than the UPDES permit required for construction, UDEQ does not have any specific regulations pertaining to the quality or treatment of runoff from a highway. Utah and Salt Lake Counties defer to UDEQ regulations for water quality issues. Therefore, the Utah Water Quality Act and the CWA are the only regulations applicable to water quality for this project.

Table 3.12-1: UDEQ Beneficial Use Classifications

| Classification | Description |
|---|---|
| 1 | Protected for use as a raw water source for domestic water systems. |
| 1C | Protected for domestic purposes with prior treatment by treatment processes as required by the Utah Division of Drinking Water. |
| 2 | Protected for recreational use and aesthetics. |
| 2A | Protected for primary contact recreation such as swimming. |
| 2B | Protected for secondary contact recreation such as boating, wading, or similar uses. |
| 3 | Protected for use by aquatic wildlife. |
| 3A | Protected for cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain. |
| 3B | Protected for warm water species of game fish and other warm water aquatic life, including the necessary aquatic organisms in their food chain. |
| 3C | Protected for non-game fish and other aquatic life, including the necessary aquatic organisms in their food chain. |
| 3D | Protected for waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including the necessary aquatic organisms in their food chain. |
| 3E | Severely habitat-limited waters. Narrative standards will be applied to protect these waters for aquatic wildlife. |
| 4 | Protected for agricultural uses, including irrigation of crops and stock watering. |
| 5 | Great Salt Lake. Protected for primary and secondary contact recreation, aquatic wildlife, and mineral extraction. |

Source: Utah Department of Environmental Quality, Division of Water Quality 2006a

#### 3.12.1.3 State of Utah Stream Alteration Permit (General Permit 40)

A stream alteration permit is required from the Utah Department of Natural Resources, Division of Water Rights, for all activities that affect the bed or banks of natural streams. General Permit 40 covers activities such as bridge or railroad construction and enables the state to have the stream alteration permit fulfill the requirements of CWA Section 404. The state's permit is subject to approval by the USACE. If the USACE determines that a stream alteration permit is not sufficient, an individual Section 404 permit from the USACE also would be required. Projects that require a Section 404 individual permit are those involving wetlands, stream relocation, or the pushing of streambed material against a stream bank using a bulldozer or similar equipment. Stream alteration permits would be required for construction activities that cross any USACE jurisdictional water of the United States.

#### 3.12.1.4 National Flood Insurance Program

Congress responded to increasing costs of disaster relief by passing the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. These acts were intended to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains. Under authority from the National Flood Insurance Act, FEMA administers the NFIP and issues flood insurance rate maps (FIRMs) for communities participating in the program.

A total of 14 communities in Utah County and 13 communities in Salt Lake County participate in the NFIP. Communities that participate in the NFIP are required to administer a permit review program based in part on FEMA-generated FIRMs as part of the local land use permitting process to minimize flood damages.

#### 3.12.1.5 Federal Floodplain Regulations

Executive Order 11988 (Flood Plain Management) and 23 CFR 650, Subpart A (Location and Hydraulic Design of Encroachments on Flood Plains), provide guidance to federal agencies on constructing projects within the boundaries of designated floodplains. Executive Order 11988 requires that all federal agencies take action to reduce the risk of flood loss; to restore and preserve the natural and beneficial values served by floodplains; and to minimize the impact of floods on human safety, health, and welfare. Federal agency actions must reflect consideration of alternatives to avoid adverse impacts in floodplains and, where such impacts are unavoidable, must modify the proposed action to minimize such impacts.

23 CFR 650, Subpart A, prescribes Federal Highway Administration (FHWA) policies and procedures for locating and designing highway encroachments in floodplains. 23 CFR 650.111 explains that “National Flood Insurance Program (NFIP) maps or information developed by the highway agency, if NFIP map are not available, shall be used to determine whether a highway location alternative will include an encroachment.” Specifically, FHWA must avoid longitudinal or significant encroachments into floodplains, where practicable, and must minimize adverse affects to floodplains resulting from its actions. 23 CFR 650.105(q) defines a “significant encroachment” as a highway encroachment and any direct support of floodplain development that would involve one or more of the following construction- or flood-related impacts:

- a significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community’s only evacuation route;
- a significant risk; or
- a significant adverse impact on natural and beneficial floodplain values.

A proposed action that includes a significant encroachment cannot be approved unless FHWA finds that the proposed significant encroachment is the only practicable alternative.

#### 3.12.1.6 Local Floodplain Regulations

Local governments often restrict fill within the floodplain through a variety of methods, such as those listed below:

- balancing cut-and-fill whereby the overall flood storage capacity of the floodplain remains constant;
- limiting fill only to the amount necessary for construction of permitted structures;
- limiting the total amount of permitted fill per site; and
- specifying permitted locations of fill on a site (e.g., designating fill for the portion of the lot farthest from the floodplain).

Regulations also center on ensuring that all structures are adequately protected from recurrent flooding:

- Buildings may be required to be floodproofed to within a specified height of flood events. Floodproofed buildings allow no water to enter below the floodproofed height. This typically means that, at or below the specified elevation, there are no entryways or windows and no habitable space.
- Codes can restrict building siting to nonfloodplain lands or portions of the lot with the shallowest potential flooding.
- Minimum buffers or setbacks from water bodies may be used. Buffers should be established based on the capacity of the water body and the slope of the shoreline.
- Some codes limit construction of fences in floodplains so that they do not collect debris or obstruct floodwaters.

One example of these local floodplain protection measures is Salt Lake County’s Jordan River Meander Ordinance, which restricts the type of development and land uses in the meander corridor (Salt Lake County 1994).

## *3.12.2 Affected Environment*

### 3.12.2.1 Utah Lake/Jordan River Basin Hydrology

The proposed transportation corridor traverses the Utah Lake/Jordan River Basin, which consists of two major sub-basins: the Utah Lake and Jordan River watersheds. The Utah Lake watershed includes all of the land that drains into Utah Lake and a portion of the Jordan River originating at the Utah Lake outlet, downstream (north) to the Jordan River Narrows, near the Utah/Salt Lake County line. Utah Lake is one of the largest natural freshwater lakes in the western United States. It occupies much of the Utah Valley and is a major source of water for Salt Lake County. The Jordan River is the only outlet for the lake and drains it north to Great Salt Lake. The South Utah, Central Utah, and North Utah County Sections are located in the Utah Lake watershed.

The Jordan River watershed includes those lands that drain into the Jordan River from the Jordan River Narrows north through the Salt Lake valley to Great Salt Lake. The South Salt Lake County Section is located in the Jordan River watershed.

The Utah Lake/Jordan River Basin is a diverse watershed that contains a variety of soil types and a wide range of vegetation communities that are common throughout the state. Annual precipitation totals vary dramatically because of large differences in elevation between the valley and mountain areas. Average annual precipitation ranges from 12 inches in the lower valleys to more than 50 inches in the highest mountain areas. Snow accumulation and melt is a very significant feature of the annual hydrologic cycle for this watershed. Extreme temperatures in the valley range from –30°F in winter to 110°F in summer. The lower valleys have average frost-free seasons of about 200 days per year from the middle of April to the end of October (Salt Lake County 2004).

Streamflow in the Utah Lake/Jordan River Basin changes because of seasonal variations in precipitation, temperature, evapotranspiration, and human-induced hydrologic modifications from dams and diversions. Hydrologic modifications may control the streamflow, altering the peak runoff periods and natural variability of the streams, which in turn affects the physical, chemical, and biological conditions of the streams and adjacent areas (U.S. Geological Survey 2002). Most of the major unregulated streams and tributaries naturally peak during May to June, with the discharge peak in lower-altitude drainages occurring earlier.

Land use in the watershed is 53% multiple use (logging, mining, grazing, and recreation on BLM, State, and U.S. Forest Service lands), 31% agricultural, and 16% urban, which includes industrial areas around the lake. The greatest impact humans have had on Utah Lake has been the elimination of most of the natural inflow to the lake (Great Salt Lake Basin Hydrologic Observatory 2004).

### 3.12.2.2 Utah Lake Watershed

The Utah Lake watershed is bound on the east by the Uinta Mountains and Wasatch Plateau, on the west by the Oquirrh and East Tintic Mountains, on the north by the Traverse, Wasatch, and Uinta Mountains, and on the south by the Wasatch Mountains and Wasatch Plateau. The watershed contains portions of three physiographic provinces: the Basin and Range, Middle Rocky Mountains, and Colorado Plateau. Elevations in the watershed range from 4,475 feet at Jordan River Narrows to 11,928 feet at Mt. Nebo in the Wasatch. The Provo, Spanish Fork, and American Fork Rivers and Hobble Creek drain the areas of the physiographic provinces within the watershed and are the primary tributaries to Utah Lake. The Provo River, Spanish Fork River, and groundwater flow contribute most of the water to Utah Lake. Provo River originates in the southwestern margin of the Uinta Mountains and drains portions of Wasatch, Summit, and Utah Counties. Spanish Fork River and its tributaries drain portions of the southern Wasatch Range. Jordan River drains Utah Lake at the lake's northern shore and is the only surface outlet for the lake.

The Provo River is controlled by two major dam sites and reservoirs: Jordanelle and Deer Creek. Water is imported to the Provo River from the Weber Basin by the Weber-Provo Canal and from the Uinta Basin through the Duchesne Tunnel. The Spanish Fork River receives water from the Uinta Basin through the Syar Tunnel. Water from the Syar Tunnel enters Sixth Water Creek, a tributary of Diamond Fork, which flows to the Spanish Fork River.

This basin covers 1,945,100 acres, of which approximately 37% is public lands owned and managed by the federal government, 6% is owned by the state government, 51% is privately owned, and 6% is owned by other parties. The U.S. Forest Service is the major federal land management agency, with jurisdiction over 782,335 acres within the basin. Land uses in the watershed include agriculture, open water and riparian, residential, industrial, and other urban uses. The remaining acreage within the watershed comprises forest and rangelands (Great Salt Lake Basin Hydrologic Observatory 2004).

#### 3.12.2.3 Jordan River Watershed

The Jordan River watershed is bound on the east by the Wasatch Mountains, on the west by the Oquirrh Mountains, and on the south by the Traverse Mountains. The Jordan River flows north and into the Great Salt Lake at the northern extent of the watershed. The Jordan River watershed is unique because it is a closed basin bound by three mountain ranges and the Great Salt Lake. The elevation of the Great Salt Lake is approximately 4,200 feet. The Wasatch Range reaches elevations higher than 11,000 feet. The Oquirrh Mountains to the west reach elevations higher than 9,000 feet.

The Jordan River meanders for approximately 58 river miles, from the outlet of Utah Lake north to the Great Salt Lake. It is fed by a number of perennial (Little Cottonwood Creek, Big Cottonwood Creek, and Mill Creek) and seasonal (Parley's Creek, Emigration Creek, Red Butte Creek, and City Creek) tributary streams, which originate in the Wasatch Mountains to the east. No major streams originate from the western side of the river.

The watershed drains 805 square miles. Approximately 370 square miles are in the rugged Wasatch, Oquirrh, and Traverse ranges. Except for limited portions of Emigration, Big Cottonwood, and Little Cottonwood canyons, the mountainous areas are almost entirely uninhabited.

Most of the lands in the upper watershed are managed by the U.S. Forest Service, which administers 91,933 acres of national forest lands in the Wasatch Range. The state of Utah has scattered land holdings of 9,778 acres. The state also owns the beds of all navigable streams and lakes. Valley floors are composed mostly of private lands. Lands used for industrial purposes are generally scattered throughout the valley, with the most significant cluster in the northwest. Agricultural areas are located in the southern and southwestern portions of the valley, with some irrigated acres in the northwest. Conversion of irrigated agricultural land to residential use, primarily at the southern end of the valley, is the current trend (Salt Lake County 2004).

#### 3.12.2.4 Drainages within Study Area

The project study area traverses six drainages and a portion of Utah Lake (Figure 3.12-1). The drainages (from south to north, in a counterclockwise direction around Utah Lake) include Spring and Beer Creeks; the Spanish Fork River; Dry Creek; Hobble Creek; the Provo and American Fork Rivers, Spring Creek, Dry Creek (in Lehi), and Jordan River. Spring Creek is the outlet of Mill Pond, located near I-15 in American Fork. The project study area also crosses various perennial and seasonal minor tributaries of the above-mentioned waterways. Canals that are located in the project study area include South Field Canal, Mill Race Canal, Matson Canal, Lake Bottom Canal, West Union Canal, Fox Ditch, Bull River Ditch, Murdock Canal, East Jordan Canal, Draper Irrigation Canal, and Jordan and Salt Lake City Canal. Figure 3.12-2 presents the Utah Lake/Jordan River Basin by type of beneficial use and attainment of beneficial use classifications, as defined by UDEQ. Table 3.12-1 shown earlier in this section, along with Table 3.12-2, presents the UDEQ beneficial use classifications and impairment determinations of the surface water bodies in the study area vicinity.


Figure 3.12-1

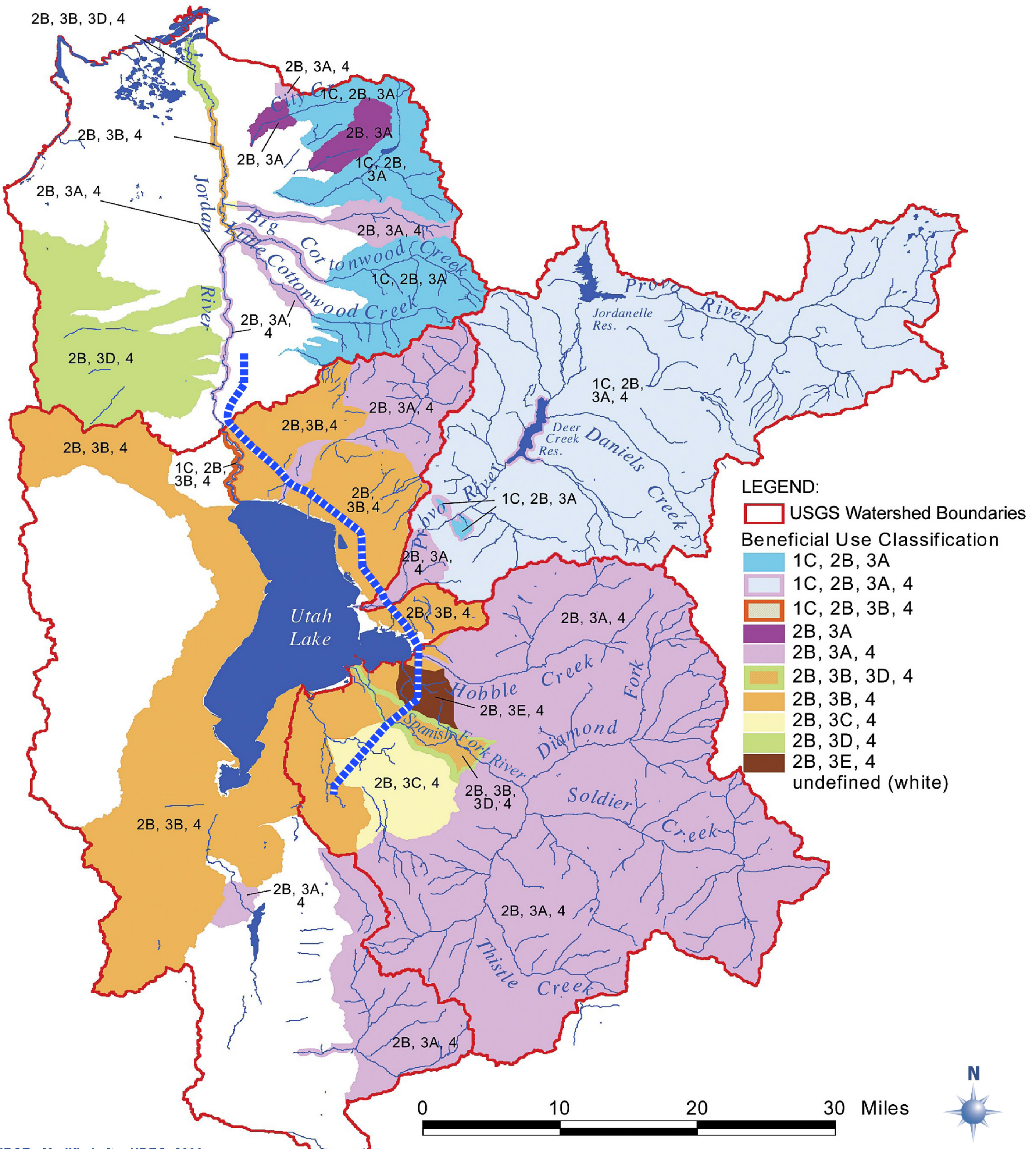
## Surface Waters and Canals Near Project Area

LEGEND:

I-15 Corridor

0 2.5 5 Miles

N




SOURCE: Modified after UDEQ, 2006.

**Figure 3.12-2**

## Jordan River and Utah Lake Watershed Unit Beneficial Use Classifications as Designated by UDEQ

**LEGEND:**

I-15 Corridor

Table 3.12-2: Beneficial Uses of Surface Waters and Impairment Designations

| Water Body | Assessment Unit Description[1] | 303(d) List of Impaired Waters? | Beneficial Use Class[2] | |
|---|---|---|---|---|
| | | | Fully Supported[4] | Partially or Not Supported (Pollutants of Concern)[5] |
| Utah Lake | Entire Lake | Yes | | 3B (Total Phosphates, Total Dissolved Solids) |
| Spring Creek | Spring Creek and Tributaries from confluence with Beer Creek to headwaters | No | 3A | |
| Beer Creek | From 48 West to headwaters | No | 2B, 3C, 4 | |
| Spanish Fork River | From Utah Lake to diversion at Moark Junction | No | 2B, 3B, 3D, 4 | |
| Dry Creek | From Utah Lake (Provo Bay) to I-15 (including tributaries) | No | 2B, 3E, 4 | |
| Hobble Creek | From Utah Lake to headwaters (including tributaries) | No | 2B, 3A, 4 | |
| Provo River | From Utah Lake to Murdock diversion | No | 2B, 3A, 4 | |
| American Fork River | Below Diversion | No | | |
| Spring Creek | From Utah Lake near Lehi to headwaters (including tributaries) | No | 2B, 3A, 4 | |
| Jordan River[3] | From Utah Lake to Narrows | Yes | 1C, 2B, 3B | 4 (Total Dissolved Solids) |
| | From Bluffdale to Narrows Diversion | Yes | 1C, 2B, 3B | 3A (Temperature),<br>4 (Total Dissolved Solids) |
| | From 7800 S to Bluffdale | Yes | | 3A (Temperature),<br>4 (Total Dissolved Solids) |

1 Units chosen were those in the direct vicinity or downstream of the project. Beneficial uses in those areas or reaches that would not be directly or indirectly affected by the proposed project are not reported.
2 See Table 3.12-1 (UDEQ Beneficial Use Classifications) above.
3 Includes several consecutive reaches. Not all beneficial uses supported apply to all reaches on the Jordan River.
4 Source: Utah Department of Environmental Quality, Division of Water Quality 2006a, 2006b
5 Source: Utah Department of Environmental Quality, Division of Water Quality 2006b

As indicated in Table 3.12-2, Utah Lake and multiple segments of the Jordan River were assessed as impaired such that they could not support their aquatic life beneficial use support designation. Utah Lake is impaired for total dissolved solids and total phosphates for warm water species of game fish and other warm water aquatic life (Class 3B water). The Jordan River from Bluffdale to the Narrows and from 7800 South to Bluffdale exceeded the temperature standard for a Class 3A water (cold water game fish) (Utah Department of Environmental Quality, Division of Water Quality 2006a). Farther downstream, segments of the Jordan River exceeded the dissolved oxygen standard. Urban stormwater runoff is considered a significant source of organic loading that creates a large oxygen demand in the lower parts of the Jordan River. In turn, this causes the oxygen level in the river to fall below State standards downstream of the proposed project (Utah Department of Environmental Quality, Division of Water Quality 2006a ).

### 3.12.2.5 Flooding

Figure 3.12-3 presents the I-15 corridor in relation to FEMA-delineated flood zones. As Figure 3.12-3 illustrates, the current I-15 alignment in the Central and South Utah County Sections crosses portions of the 100-year floodplain associated with Utah Lake and the Spanish Fork River. Segments of the existing alignment in the South Salt Lake County and North Utah County Sections are in the 100-year floodplain. Segments of the existing alignment in the North, Central, and South Utah County Sections are within the 500-year floodplain.

### 3.12.2.6 Groundwater

*Groundwater Hydrology*

Groundwater in the Great Salt Lake Basin is contained within unconsolidated basin-fill deposits in the valleys and basins and consolidated rocks in the mountains (Figure 3.12-4). The basin-fill deposits are the principal source of groundwater for domestic and municipal supply and for irrigated agriculture. The deepest and oldest parts of the basin-fill deposits are composed of sediments that were eroded from adjacent mountain ranges and have subsequently become semi-consolidated to consolidated by compaction and cementation. The shallower, younger basin-fill deposits consist of interbedded lacustrine and alluvial sediments that are less compacted and cemented, and generally are more permeable than the underlying, older deposits. The most permeable sediments are remnants of large, prehistoric alluvial fans and deltas, and are composed mainly of gravel and sand deposited near the mountain fronts. These coarser materials form the principal basin-fill aquifers in the Salt Lake and Utah Valleys.

The basin-fill aquifers are classified into two types: shallow aquifers and principal aquifers. The shallow, generally unconfined aquifers consist primarily of coarse-grained basin-fill deposits that are separated from the confined part of the principal aquifers by fine-grained sediments, which form discontinuous confining layers. The shallow aquifers contain the water table, or the first saturated zone in the subsurface, and generally occur in the secondary recharge and discharge areas. The land overlying the shallow groundwater is largely developed and used mainly for agricultural, commercial, industrial, and residential purposes. The shallow aquifers are typically present within the upper 50 feet of basin-fill deposits and therefore are vulnerable to contamination because of the close proximity to human activities at land surface. Low yields and poor quality limit the use of water from shallow aquifers.

The principal aquifer in each basin or valley includes a deep, unconfined aquifer along the mountain front that becomes confined in the valleys where layers of clay, silt, sandy clay, or silt and clay more than 20 feet thick overlie and confine the aquifer. The deep, unconfined portion of the principal aquifer in a basin corresponds to that of a primary recharge area and a lack of substantial confining layers. It may occupy a relatively narrow area if the confining layers are close to the mountain front. The depth to the water table is typically 150 to 500 feet below the land surface. The land above the deeper unconfined aquifers in the study area has generally been undeveloped or is used for residential and commercial purposes. However, as population increases, more land is being developed for residential and commercial use. These aquifers are vulnerable to contamination and are a major source of drinking water to the Utah Valley's population.

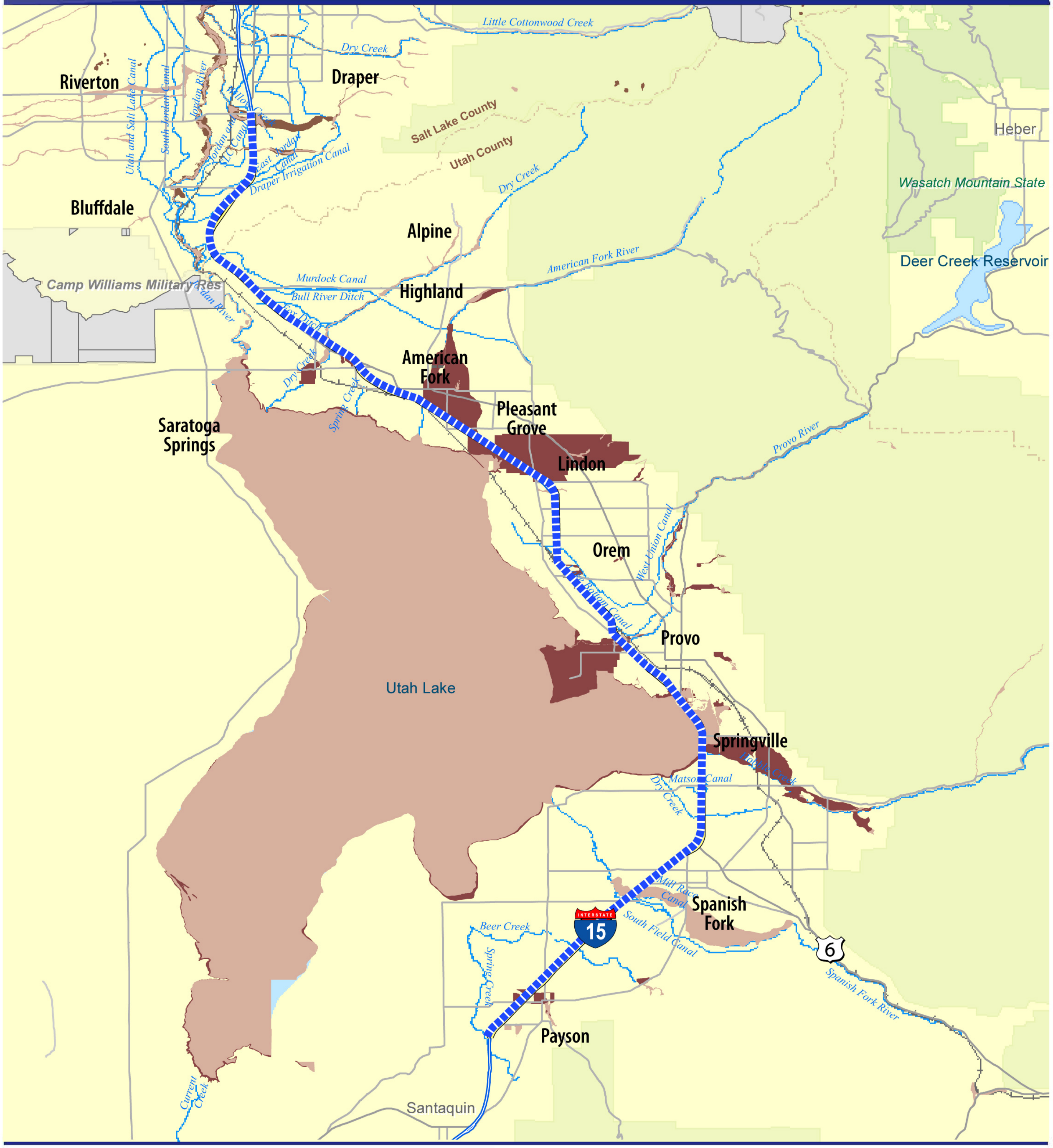



Figure 3.12-3

**FEMA-Delineated Floodplains Near Project Area**

**LEGEND:**

I-15 Corridor | **100-yr floodplain** | **500-yr floodplain** | **No floodplain data available**

0 2.5 5 Miles

N

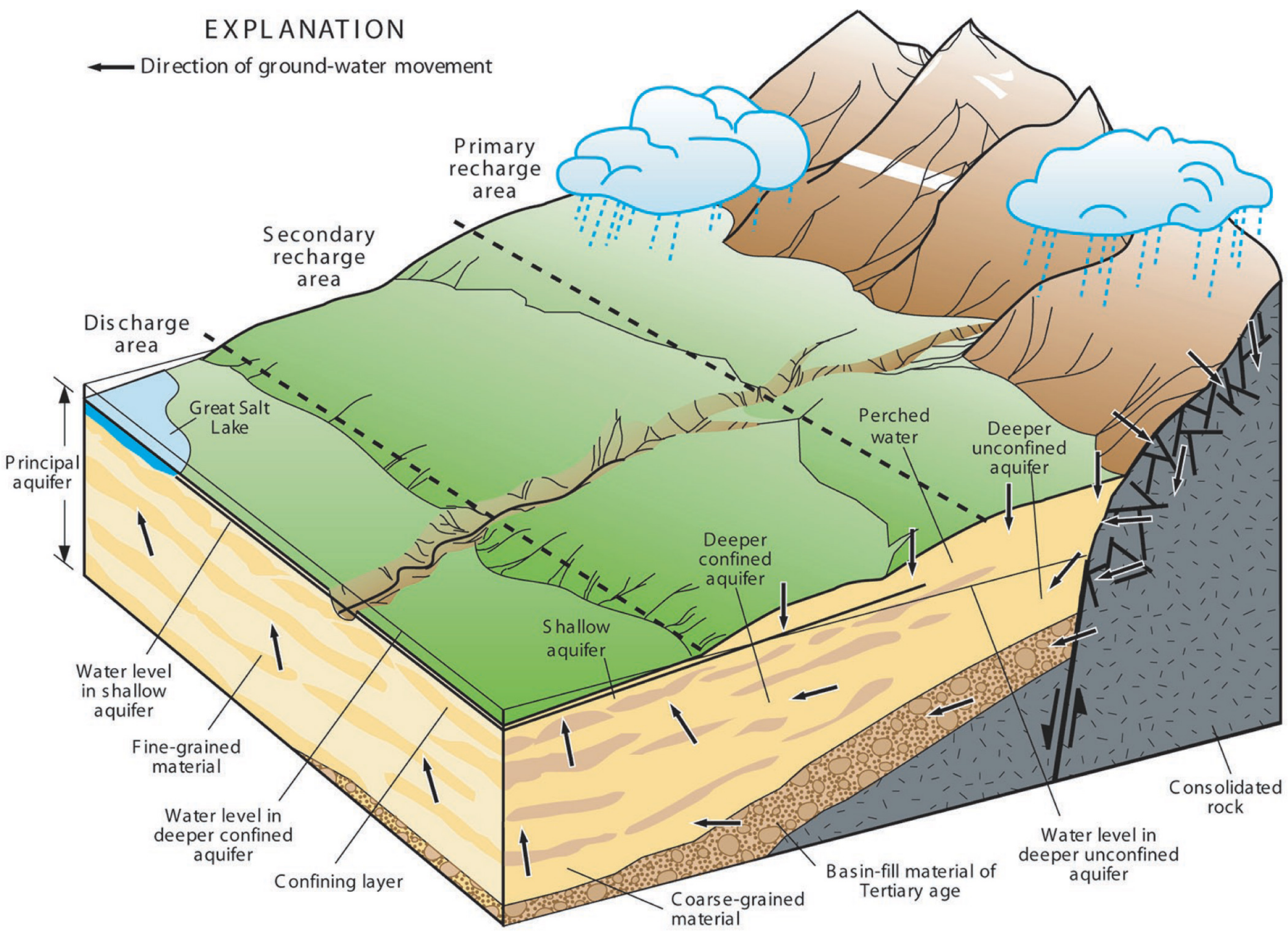



**Figure 3.12-4**

## Groundwater Movement and Recharge in the Great Salt Lake Basin

SOURCE: Baskin et al., 2002.

The deep, confined part of the principal aquifer is recharged by the adjacent deep, unconfined aquifer and by the overlying shallow aquifer, where a downward hydraulic gradient exists and the confining layers are discontinuous. It is susceptible to contamination by flow reversals caused by large amounts of groundwater withdrawal and is also a major source of drinking water. Perched aquifers generally occur above localized lenses of finer-grained deposits overlying the deep, unconfined aquifers. They can be the source of water for springs used for agricultural and livestock purposes but are not typically geographically extensive and are less likely to receive contamination from land surface than the deeper aquifers (confined and unconfined).

Groundwater in the study area generally comes from precipitation in the mountains or on valley benches, where it infiltrates the soil and percolates downward through the basin-fill deposits to the principal aquifers. Groundwater in the principal aquifer in each subarea flows toward the center of the valley and discharges to springs, streams, lakes, and upward to the shallow aquifer. The coarse-grained deposits along the mountain fronts, including large portions of the project study area, are important recharge areas. These recharge areas generally have high hydraulic-conductivity values, and groundwater typically moves rapidly from the land surface into the unconfined part of the principal aquifers. Recharge and discharge areas are shown in Figure 3.12-5. Classifications of recharge and discharge areas were qualitative[1], and no estimates of recharge or discharge were made (U.S. Geological Survey 2002).

### *Groundwater Quality*

Subsurface inflow from the Wasatch Range is the main source of recharge to the deeper aquifer on the east side of the valley, and local precipitation and irrigation water are the main sources of recharge to the shallow system. As a result, the deeper aquifer in this part of the valley is more isolated than the shallow groundwater from activities occurring at the land surface. No large hydraulic gradient exists between the shallow and deeper aquifers in the northwestern part of the valley, and anthropogenic (human-produced) compounds are more prevalent in the shallow groundwater. Pumping from the deeper confined aquifer, however, may cause water and anthropogenic compounds to move downward.

A major groundwater quality issue is the effect of urbanization and groundwater development on water quality. Increased withdrawal of groundwater for public supply and irrigation has induced the movement, both vertical and lateral, of naturally occurring groundwater and anthropogenically affected poorer-quality groundwater. The principal aquifers in the study area include the deeper unconfined and confined parts of the unconsolidated basin-fill aquifers.

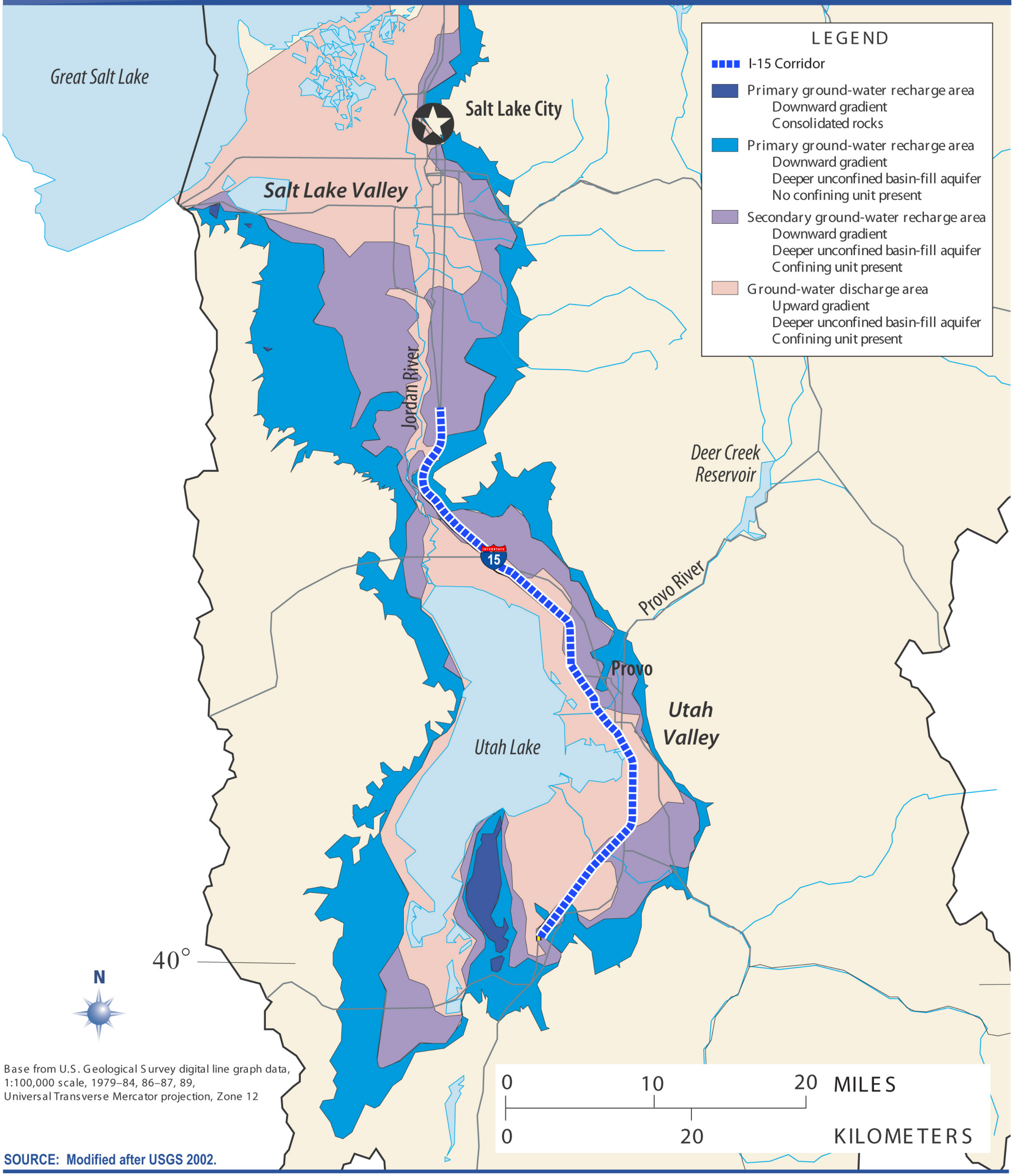
Primary recharge areas have the greatest potential for transmitting contamination to the principal aquifers because of the predominance of coarse-grained sediments and the absence of confining layers within these areas. The coarse-grained sediments in the primary recharge areas typically have large hydraulic conductivity values, and groundwater commonly moves rapidly from the surface down to the principal aquifer. Figure 3.12-5 depicts recharge areas in the project study area.

[1] Areas are classified as primary recharge areas, secondary recharge areas, or discharge areas based on the following definitions:

Primary Recharge Area: Occurs where fine-grained basin-fill deposits that form confining layers between the land surface and the water table are not thicker than about 20 feet. The occurrence of the deeper, unconfined aquifer corresponds with that of primary recharge area.

Secondary Recharge Area: Occurs where a confining layer is present between the land surface and principal aquifer. Where a shallow aquifer is present above the first confining layer, the direction of groundwater movement between the shallow aquifer and confined part of the principal aquifer generally is downward.

Discharge Area: Occurs where the direction of groundwater movement is upward, from the confined part of the principal aquifer to the shallow unconfined aquifer. Discharge areas generally occur in the lowest topographical parts of valleys.




SOURCE: Modified after USGS 2002.

Figure 3.12-5

## Groundwater Recharge and Discharge Areas in the Great Salt Lake Basin Study Unit

In secondary recharge areas, the greatest potential for surface contamination to reach the principal aquifer is near the boundary between the secondary and primary recharge areas. Near this boundary, confining layers in the basin fill are generally thinner than they are elsewhere in the secondary recharge areas, and the hydraulic gradient between the shallow aquifer and principal aquifer is higher than that near the boundary between the secondary recharge and discharge areas. In discharge areas, the water moves upward from the principal aquifer; therefore, there is little or no potential for contamination unless pumping from the deeper aquifer is great enough to reverse the vertical gradient or a contaminant is heavier than water (U.S. Geological Survey 2002).

*Groundwater Rights*

Water rights in Utah are administered by the Utah Department of Natural Resources, Division of Water Rights, and are defined as a right to the use of water based on: 1) quantity, 2) source, 3) priority date, 4) nature of use, 5) point of diversion, and 6) physically putting water to beneficial use (Utah Department of Natural Resources, Division of Water Rights, 2005). Figure 3.12-6 indicates the location of existing groundwater rights in the project study area. Individual groundwater rights may represent one or more actual groundwater wells. Uses of these wells include domestic, irrigation, municipal, stock watering, and other uses, which include uses not previously defined, such as recreational or industrial.

#### 3.12.2.7 De-Icing Operations

The following provides a brief discussion of typical de-icing methods employed by UDOT throughout the state of Utah to prevent ice from building up on roads. This section is presented to provide information on what constituents are likely to occur in the surface and shallow groundwater systems along the I-15 corridor. The discussion is summarized from the FHWA and the USACE's *Final Legacy Parkway Supplemental Environmental Impact Statement/Reevaluation and Section 4(f), 6(f) Evaluation* (2005).

De-icing methods used by UDOT include the application of salt, pre-wetting, and anti-icing. The application of granular salt to a roadway is the most widely used de-icing method. However, UDOT minimizes the use of salt to the extent possible for economic and environmental reasons. Pre-wetting refers to mixing liquid brine (e.g., salt water, typically magnesium chloride) at the spreading disk just before the salt is applied to the road. When the salt is wet, it binds more effectively to the roadway and is less likely to be blown off the road by passing vehicles. Pre-wetting increases the effectiveness of using salt as a de-icing method and reduces the overall quantity of salt required. Anti-icing refers to spreading liquid brine before snow or ice accumulates on the road. This method requires anticipating weather cycles, precipitation, and temperatures.

### *3.12.3 Alternative 1: No Build*

The potential impacts under Alternative 1 would be the same for the South Utah, Central Utah, North Utah, and South Salt Lake County Sections. Floodplain, construction-related water quality, surface water quality, and groundwater quality impacts are discussed below.

#### 3.12.3.1 Floodplain Impacts

The existing I-15 alignment crosses portions of the 100-year floodplain. No additional impacts on floodplains would occur under Alternative 1.

#### 3.12.3.2 Construction-Related Water Quality Impacts

No water quality impacts resulting from construction of the project would occur under existing conditions under Alternative 1. Future transportation improvement projects would be undertaken, as described in Chapter 2 "Alternatives Considered," section 2.4.1. It is likely that these future projects would have construction-related water quality impacts.


Figure 3.12-6
## Groundwater Rights in the Project Area

**LEGEND:**

- I-15 Corridor
- I-15 Alignment Right of Way
- Groundwater Rights Locations within Proposed Project Right of Way

0 2.5 5 Miles

N

Data Source: Utah Department of Natural Resources, Utah Division of Water Rights, 2004

#### 3.12.3.3 Surface Water and Groundwater Quality

Under Alternative 1, the current water quality treatment methods would be maintained, and no additional impacts on surface water quality would occur. Alternative 1 would not result in impacts on groundwater quality; recent conditions and trends in the quality of groundwater would likely continue to occur.

### *3.12.4 Alternative 4: I-15 Widening and Reconstruction*

The impacts of Alternative 4 on floodplains, surface and groundwater quality and water rights are presented for the I-15 corridor project as a whole, inclusive of all four geographic sections.

#### 3.12.4.1 Floodplain Impacts

Proposed improvements under Alternative 4 would remain in FEMA-designated 100-year floodplains associated with Utah Lake, the Spanish Fork River, Hobble Creek, the Provo River, and the Jordan River, where the existing I-15 alignment already encroaches. Installation of Alternative 4 features in these floodplains could potentially result in alteration to floodflows or the extent of the floodplain. In addition, Alternative 4 would increase the area of impermeable surfaces from 730 acres to 1,290 acres, an increase of 77%, and increase the stormwater runoff volume from the project site. These increased flows could potentially alter floodflows if they were not captured before flowing into local surface waters. However, detention basins that would be implemented as part of Alternative 4 would capture additional runoff flows from the project site. The proposed detention basins would be designed to release stormwater flows at a rate of 0.2 cubic feet per second (cfs) per acre from the project site for a 50-year, 24-hour storm based on the TR-55 Graphical Peak Discharge Method[2]. Under Section 3.4 of the "UDOT Manual of Instruction – Roadway Drainage", the NRCS Synthetic Hydrograph, TR-55, is listed as one of the acceptable methods for estimating run-off drainage of drainage structures. TR-55 is a computer model that creates an NRCS Synthetic Hydrograph. The program estimates storage volumes for detention basins by comparing the inflow hydrograph to the outflow hydrograph based on the allowable outflow (0.2 cfs per acre) and the inflow calculated for the drainage area. Releases from the detention basins would be discharged into local surface waters, including ditches, irrigation flumes, Spring Creek, Beer Creek, the Spanish Fork River, Dry Creek, Hobble Creek, the Provo River, Lake Bottom Canal, the American Fork River, and Spring and Dry Creeks.

Implementation of the floodplain conveyance and surface water conveyance mitigation measures described below would mitigate the potential floodplain impacts of Alternative 4. These features would ensure that, during a flood period, evacuation and emergency vehicle routes would be maintained and that the natural floodplain values of the study area would not be diminished. Therefore, implementation of Alternative 4 would meet the requirements of both Executive Orders 11998 and 23 CFR 650, Subpart A.

#### 3.12.4.2 Surface Water Quality

Alternative 4 would increase impermeable surface area and would subsequently increase the volume of runoff from the project site. Increased runoff and impermeable surfaces would increase the potential for the transport of pollutants to local surface waters, especially at stream crossings.

A stream crossing is a location where a road crosses a stream, river, or canal. Stream crossings require structures such as bridges or culverts to allow the water to pass under the road. Depending on the design and construction methods used for the I-15 project, the encroachment of the roadway into a stream and the culverts and bridges at stream crossings could adversely affect a stream's natural flow pattern, profile, channel stability, aquatic habitats, streambank vegetation, or riparian habitats. Encroachment can also increase the stream's velocity and can cause downstream erosion. The closer the roadway is to a stream, the greater the potential for

[2] *Urban Hydrology for Small Watersheds, TR-55*. United States Department of Agriculture, Natural Resources Conservation Service, Conservation Engineering Division, Technical Release 55, June 1986.

water to run off the road without undergoing water quality treatment before it enters the stream. BMP's will also ensure that no untreated run-off from roadways, bridges or other structures will drain into streams or rivers. Types of water quality treatment include detention basins, vegetated swales or bioswales, aeration, or reaction to sunlight. The greater the number of stream crossings, the more quickly the roadway runoff can enter the stream if it is not detained.

The I-15 team completed analyses to assess potential impacts to surface water quality. Impacts to surface waters were evaluated based on the following data and analysis:

- The amount of impervious (paved) area added
- The number of stream crossings
- A numeric analysis of typical roadway runoff pollutants to determine if numeric water quality standards would be exceeded. Impacts to the beneficial uses of water bodies in the impact analysis area were evaluated by Mountain View Corridor (UDOT 2007). The I-15 project assumes similar conditions and the same impaired waters (Jordan River and Utah Lake) as the Mountain View Corridor Project. Therefore, this numeric water quality modeling was not repeated for I-15.
- Potential to affect the impaired 303(d)-listed waters in the I-15 corridor (Jordan River and Utah Lake)
- Potential to affect the surface water's beneficial-use classification.

Under Alternative 4, the amount of impervious area on I-15 would increase from 730 acres to a maximum of 1290 acres. This additional impervious area from roadway pavement can affect water quality in several ways. These include:

- Increased volume of stormwater runoff discharged into streams, which can increase the velocity of the water in the stream. Higher water velocities increase the potential for erosion, and erosion increases the concentration of total dissolved solids (TDS) and total suspended solids (TSS) in the stream.
- Increased paved area which requires more de-icing chemicals, which can increase TDS levels.
- Increased automobile traffic, which can increase several automobile-related pollutants, primarily copper, lead, and zinc.
- Reduced infiltration of stormwater into the soil. Infiltration treats and improves water quality because microbes in the soil help filter pollutants and because particulates settle out of the stormwater into the soil.

To evaluate impacts from the I-15 alternatives, typical contaminants from highway runoff were considered. These contaminants are listed in Table 3.12-3. Four highway runoff contaminants were evaluated using different methods of numeric analysis. Concentrations of copper, lead, and zinc were modeled using the Federal Highway Administration's (FHWA) numeric water quality model (see Section 1.4, FHWA Numeric Analysis). Concentrations of TDS were assessed by modeling the concentrations of de-icing chemicals and by using event mean concentration (EMC) values from the Stormwater Quality Data Technical Report prepared for Salt Lake County (Salt Lake County 2000).

Table 3.12-3: Typical Highway Runoff Contaminants

| Contaminant | Sources |
|---|---|
| Bromide | Exhaust |
| Cadmium | Tire wear, herbicide application |
| Chloride | De-icing salts |
| Chromium | Metal plating, engine parts, brake lining wear |
| Copper | Metal plating, bearing wear, engine parts, brake lining wear, fungicide and insecticide use |
| Cyanide | Anti-cake compound used to keep de-icing salts granular |
| Iron | Auto body rust, steel highway structures, engine parts |
| Lead | Tire wear, lubricating oil and grease, bearing wear, atmospheric deposition |
| Manganese | Engine parts |
| Nickel | Diesel fuel and gasoline, lubricating oil, metal plating, brake lining, asphalt paving |
| Nitrogen, phosphorous | Atmosphere, sediments |
| Particulates (sediments or TSS) | Pavement wear, vehicles, atmosphere, maintenance, snow/ice abrasives, sediment disturbance |
| Pathogen Bacteria Waste | Soil, litter, bird droppings, trucks hauling livestock/stockyard |
| Polychlorinated biphneyls (PCBs) | Spraying of highway rights-of-way, atmospheric deposition, catalyst in synthetic tires |
| Petroleum | Spills, leaks, blow-by motor lubricants, antifreeze, hydraulic fluids, asphalt surface leachate |
| Rubber | Tire wear |
| Sodium, calcium | De-icing salts, grease |
| Sulfate | Roadway beds, fuel, de-icing salts |
| Total dissolved solids (TDS) | De-icing salts, vehicle deposits, pavement wear |
| Zinc | Tire wear, motor oil, grease |

Source: FHWA 1996

FHWA's numeric water quality model quantifies the impacts of metals in the highway runoff on surrounding water quality. The model is explained in two FHWA research documents: FHWA-RD-88-006, *Pollutant Loadings and Impacts from Highway Stormwater Runoff* (FHWA 1990), and FHWA-RD-96-095, *Retention, Detention, and Overland Flow for Pollutant Removal from Highway Stormwater Runoff* (FHWA 1996).

The available data indicate that the heavy metals considered in this analysis (copper, lead, and zinc) are the dominant toxic pollutants contributed by highway stormwater runoff. The procedure used for this analysis is a probabilistic dilution model developed and applied in EPA's Nationwide Urban Runoff Program and reviewed and approved by EPA's Science Advisory Board. The model allows the user to determine how often a certain concentration of a pollutant will occur in a stream given the variable and intermittent discharges of water that are produced by stormwater runoff. The model computes the highest in-stream concentration of the pollutant that is expected to occur over a 3-year period after the runoff is mixed with and diluted by the water in the stream (FHWA 1990, 1–2.)

Flow rates for the modeled streams were determined from U.S. Geological Survey gage data. The analysis assumes that the concentrations of each pollutant of concern in the stormwater runoff are similar to the EMCs as analyzed from samples collected during storm events for various locations in Salt Lake County from 1992 to June 2000. These samples were taken as part of the Utah Pollutant Discharge Elimination System permit requirements for Salt Lake County, the Utah Department of Transportation (UDOT) Region 2, and Salt Lake City. The roadway sampled for the report is Interstate 215 (I-215) between the Jordan River and a location about 1,700 feet east of Fashion Boulevard (about 300 East) (Salt Lake County 2000). These EMCs were used since they were more site-specific than the average values suggested by the numeric analysis documentation (FHWA 1996). The values used in the analysis are shown in Table 3.12-4.

Table 3.12-4: Event Mean Concentrations during Sampled Storm Events

| Pollutant | EMC (mg/L) |
|---|---|
| Total copper | 0.039 |
| Total lead | 0.031 |
| Total zinc | 0.181 |
| TSS | 116 |
| TDS (sampled in April, May, June, Sept. and Oct.) | 581 |

EMSs are an average over 5 years from 1995 to 2000
Mg/L = milligrams per liter
Source: Salt Lake County 2000

Runoff from the I-15 action alternatives would undergo water treatment primarily through detention basins. The pollutant removal rates of detention basins in the FHWA document (FHWA 1996) were replaced with the more conservative removal rates recommended in UDOT's literature (UDOT 2003) (see Table 3.12-5).

Table 3.12-5: Percentages of Pollutants Removed by Detention Ponds

| Pollutant | Percent Removed |
|---|---|
| Copper | 44%[a] |
| Lead | 69%[b] |
| Zinc | 59%[b] |

[a] Source: FHWA 1996, 72
[b] Source: UDOT 2003, 30 (A removal percentage for copper was not provided in this document.)

UDOT applies salt on its roads to reduce ice and improve traction during heavy snowfall. UDOT applies slightly more salt along the Wasatch Front than in the rest of the state. Along the Wasatch Front, UDOT uses two different methods to apply salt for a winter storm (Chaney 2008). These methods are based on forecasting and now-casting (forecasting at the moment when the storm begins) by the UDOT Meteorological Center and meteorological consultants as well as through local observations from UDOT maintenance personnel and meteorologists. Based on these predictions, salting trucks are mobilized and salt is applied as follows:

- Brine is applied once per storm at a rate of 15 gallons per lane-mile with a salt concentration of 23%.
- Each application of salt consists of 250 lbs per lane-mile.
- Salt will be spread at the beginning of a snow storm and again for every 3 inches of additional snowfall.

Not all of the salt applied to the road reaches surface water. Some of the salt is precipitated onto the road surface, and some is dissolved in the runoff from melted snow and ice. Much of the granular salt is re-deposited along the road shoulders, and some of the dissolved salts from these deposits infiltrate into the roadside soils with the runoff. Some salt could run off into adjacent streams as the snow melts. Dissolved solids are typically measured in the form of total dissolved solids (TDS).

Table 3.12-6 shows the calculation for TDS concentrations in snowmelt due to UDOT's anti-icing operations assuming that 100% of the salt applied is immediately dissolved and runs off the right-of-way.

Table 3.12-6: Approximate TDS in Snowmelt Runoff Due to Anti-icing Operations

| Inputs or Standards | Description | Assumptions or Results |
|---|---|---|
| Storm event | Total snowfall depth | 6 inches |
| Anti-icing | Number of brine applications | 1 |
| | Number of road salt and brine applications | 2 |
| Roadway Data | Total inside paved shoulder width | 24 feet |
| | Total number of traffic lanes and auxiliary lanes | 12 lanes |
| | Total outside paved shoulder width | 24 feet |
| | Total tributary vegetated width within right-of-way | 0 feet |
| Salt applied | Salt quantity due to brine | 5.53 $ft^3$/mile |
| | Salt quantity due to spreader | 45.00 $ft^3$/mile |
| | Total salt applied | 50.53 $ft^3$/mile |
| Run-off | Run-off from snowmelt | 45,619 $ft^3$/mile |
| Results | Approximate TDS in snowmelt runoff due to TDS anti-icing operations | 1,108 ppm |

Shaded cells are required input variables.
ft3/mi = cubic feet per mile
ppm = parts per million
mg/L = milligrams per liter

Assumptions used in the calculation are:

- Water content of snow is 10%.
- Brine is applied once per storm at a rate of 15 gallons per lane-mile with a salt concentration of 23 %.Each application of salt consists of 250 pounds per lane-mile.
- Salt is spread at the beginning of a snowstorm and again for every 3 inches of additional snowfall.
- All salt applied is dissolved in snowmelt runoff from pavement and tributary vegetated areas within the right-of-way.
- Brine and salt are applied to traffic lanes and auxiliary lanes only.
- Runoff coefficient for pavement = 0.9.
- Runoff coefficient for vegetated right-of-way = 0.25.
- Specific gravity (unit weight of salt) = 2.165 (135 pounds per cubic foot); dry bulk density of rock salt for de-icing = 80 pounds per cubic foot.
- One cubic foot of rock salt is approximately 60% salt by volume.

These assumptions are based on numbers from UDOT Environmental (Chaney 2008) specifically for the Wasatch Front.

The typical concentrations of TDS in highway runoff as sampled for highway projects are 581 mg/L (milligrams per liter). The location of this sampling was an outlet to the Jordan River at I-215 (Salt Lake County 2000). As shown above in Table 3.12-6, approximate TDS in Snowmelt Runoff Due to Anti-icing Operations, the estimated TDS concentration was 1,108 ppm, which assumes that 100% of the salt is dissolved and runs off the roadway. Both the modeled and observed concentrations of TDS taken from the Jordan River at I-215 are less than the Utah in-stream agricultural TDS standards of 1,200 mg/L for crop irrigation and 2,000 mg/L for stock watering. The existing concentrations of TDS in the streams that were modeled are below the standards for their beneficial uses. Because UDOT expects to use similar de-icing methods on the I-15 as the methods it uses on I-215, periodic increases in TDS levels in the receiving waters in the impact analysis area could be anticipated in the winter and early spring. The TDS standard applies to agricultural uses only. The majority of agricultural uses of water occur in the middle to late spring, summer, or fall. De-icing is typically not done during these periods. Consequently, any increases in TDS levels from de-icing would not occur when the majority of water for agriculture would be required. Most importantly, I-15 would not change the beneficial uses of streams in the impact analysis area as a result of an increase in TDS levels.

*Surface Water Quality Impacts*

For the FEIS, analyses added the TDS spreadsheet, and consideration of the FHWA numeric analysis, as described above. Both analyses show that the project will not further impair either the Jordan River or Utah Lake, which are the only two 303(d)-listed impaired waters in the study area. The analyses also show that the project will not alter the Beneficial Use Classification of any waters in the study area.

As a result of the Utah Lake and Jordan River impairment status, additional stormwater quality treatment measures and implementation of best management practices (BMPs) would be necessary to mitigate potential project impacts on the water quality of local surface waters.

### 3.12.4.3 Groundwater Quality

Alternative 4 has potential to generate certain constituents, as described in the surface water impact discussion above, through the use and maintenance of the highway and the increase in impervious surfaces. These pollutants could potentially seep into groundwater and affect existing groundwater quality, particularly salt concentrations. Effects on confined aquifer groundwater quality could affect local water supplies. Most of the Alternative 4 alignment overlies groundwater discharge and secondary recharge areas (Figure 3.12-5). Minimal portions of the alignment overlie primary groundwater recharge areas. Both the groundwater discharge and secondary groundwater recharge areas have confining units that restrict the vertical transport of groundwater from shallow, unconfined aquifers to deeper, confined aquifers. In addition, groundwater would have an upgradient in the groundwater discharge areas. The confining layer and upgradient flow of groundwater would restrict the infiltration of surface runoff into the principal confined aquifers and would minimize the potential effects on groundwater quality. However, Alternative 4 would be likely to contribute to adverse, though insignificant, effects on the existing water quality of the shallow aquifer in the study area. Implementation of mitigation measures to protect the surface water quality, such as minimizing salt application, is described below and would also mitigate the potential groundwater quality impacts of Alternative 4.

#### 3.12.4.4 Groundwater Rights

Groundwater rights and their associated wells occur in the Alternative 4 limits of disturbance, as indicated in Figure 3.12-6. Wells located in the limits of disturbance would be affected by implementation of Alternative 4 because the owners of the wells would not be able to maintain ownership. The approximate number of wells affected by Alternative 4 is shown in Table 3.12-7. Implementation of the mitigation measure for groundwater rights compensation would reduce the impact on groundwater-rights owners in the limits of disturbance.

Table 3.12-7: Affected Groundwater Rights within the Limits of Disturbance[a]

| Classification of Water Rights | South Utah County Section | Central Utah County Section | North Utah County Section | South Salt Lake County Section |
|---|---|---|---|---|
| Domestic | 12 | 44 | 28 | 5 |
| Irrigation | 10 | 55 | 59 | 8 |
| Stock Watering | 25 | 40 | 37 | 13 |
| Municipal | 0 | 0 | 17 | 0 |
| Other[b] | 1 | 2 | 4 | 0 |
| Total[c] | 48 | 141 | 145 | 26 |

[a] *Affected groundwater rights* represents groundwater rights located within the limits of disturbance.
[b] *Other* constitutes a range of uses not classified above, such as recreational or industrial.
[c] The totals shown in the table are different than the actual number of water rights in the limits of disturbance because some water rights have more than one classification and some have no classification.
Source: Utah Division of Natural Resources, Department of Water Rights, 2004

As described above, Alternative 4 would disturb soils during construction activities and increase the area of impervious surfaces compared to existing conditions. These activities could increase the potential transport of pollutants from the project site to groundwater wells outside the limits of disturbance. Pollutants in the runoff could potentially affect the groundwater quality in or near the wells and potentially affect the ability of the well owners to utilize their water rights. However, as described under the construction-related water quality and surface water quality impact discussions, all surface water runoff during construction activities would be captured and treated within the limits of disturbance.

### 3.12.4.5 Comparison of Design Options

Options A, B, C, and D in the Provo/Orem area would have the same impacts on floodplains. The design of the structures that would cross the Provo River floodplain would be the same, regardless of option. All would maintain the floodplain values and not increase encroachment into the floodplain over Alternative 1 No Build. The American Fork Main Street Options A, B and C do not cross or impact any floodplain.

The Preferred Alternative includes Option D in Provo/Orem and Option C in American Fork. Further details about the refinements made to the Preferred Alternative are located in Chapter 2.

The additional impermeable surface area for Provo/Orem Options A, B, C, and D and for American Fork Options A, B, and C are shown in Table 3.12-8.

Table 3.12-8: Comparison of Additional Impermeable Surface Area (in acres) by Design Option

| Central Utah County Provo/Orem Options | | | | Northern Utah County American Fork Main Street | | |
|---|---|---|---|---|---|---|
| A | B | C | D | A | B | C |
| 266 | 247 | 234 | 220 | 63 | 66 | 66 |

#### 3.12.4.6 Indirect Impacts

No indirect impacts are expected.

### *3.12.5 Mitigation*

UDOT will be required to obtain a State of Utah Stream Alteration Permit (General Permit 40) and an individual Section 404 Permit from the USACE and to prepare specific design standards that ensure that the proposed project features (i.e., bridge abutments, footings, and other features in the floodplain) do not reduce the capacity of the channels upstream or downstream of the structures or increase channel erosion. During final design of the Preferred Alternative, UDOT will undertake hydraulic modeling. These analyses will consider the final engineering of highway structures and drainage facilities across the floodplains, and indicate appropriate drainage mitigation to be implemented by UDOT, such as floodplain equalization culverts. UDOT will comply with local floodplain ordinances and permits.

Surface water conveyance structures will be designed and constructed to allow for the free movement of water to minimize increases in channel gradients, and to minimize concentrated discharges to waterways in the proposed project area. Types of surface water conveyances that could be implemented may include culverts, a series of small culverts, French drains, corrugated strip drains, synthetic drainage nets, and gravel layers.

A stream alteration permit from the Utah Department of Natural Resources, Division of Water Rights, will be required and obtained for the river and stream crossings that will result in a major stream alteration or modification. Stream alteration permits are generally combined with the USACE's Section 404 permit application to facilitate a streamlined permitting process.

UDOT will contact the operators of canals and other irrigation facilities before construction activities begin and will coordinate with the owners of these facilities to avoid or minimize impacts.

A storm water pollution prevention plan (SWPPP) will be prepared by UDOT or its contractors to comply with the required Utah Pollutant Discharge Elimination System (UPDES) permit. It will include measures to minimize potential for erosion or scour within the limits of disturbance and in local affected waterways. The SWPPP will focus on erosion-sensitive areas, sediment-sensitive areas, and control and precautionary measures to be followed. Other elements of the SWPPP will include a maintenance schedule of BMPs, drainage and culvert systems, pre- and post-construction hydrology, non-stormwater discharges, waste disposal, dust control, re-vegetation, and monitoring procedures. Applicable BMPs that will be implemented on the project site as part of SWPPP implementation will be selected from the developed standard UDOT construction BMPs and may include, but are not limited to, the following measures:

- Water pollution prevention control measures will be scheduled and implemented to correspond with ground-disturbing activities.
- Erosion control measures, such as erosion control blankets, fiber wattles, and berms, will be installed within 100 yards of all natural waterways.
- In-stream construction or diversion activities will be performed in the low-flow season.

- Only clean, granular material, rock, or aggregate will be used for the construction of temporary dikes or cofferdams, and permanent riprap.
- Waste disposal will occur according to federal, state, and county health and pollution control regulations.
- Repair or refueling of construction equipment will be performed at least 100 feet from surface waters.
- Turbidity levels in surface waters will meet EPA and UDEQ requirements through the implementation of measures including, but not limited to, brush or rock filters, silt fences, sediment traps, check dams, filter strips, sand bag barriers, or flotation silt curtains.
- Turbidity levels will be monitored frequently during in-stream construction activities. If an applicable federal or state turbidity requirement is exceeded, all construction activities will cease until the turbidity levels are less than the applicable standard.
- Activities with a high potential for causing sediment transport will not be performed during high runoff flows.
- Re-vegetation of areas disturbed by the Preferred Alternative will occur immediately after the completion of construction activities.

Selected BMPs will be used to prevent runoff from leaving the limits of disturbance. BMPs will ensure that no untreated run-off from roadways, bridges, or other structures will drain into streams or rivers. Final selection of BMPs will consider input from UDEQ and the USACE.

In the event of any accidental spills of hazardous materials during construction, UDOT will be required to take immediate appropriate action. In accordance with UDOT Specification 01355, the contractor will notify the engineer and UDEQ of spills of petroleum-based products or hazardous waste if the release meets the definition of a hazardous waste as defined in 40 CFR 261.

Measures to treat the water quality of stormwater runoff from the limits of disturbance will be implemented to remove oils, grease, sediments, and heavy metals. BMPs to treat water quality will be selected from UDOT's developed standard measures and may include vegetated filter strips, oil and water separators, outlet protection, and erosion control blankets. These measures will be implemented along the entire Preferred Alternative alignment. Final selection of BMPs will consider input from UDEQ and the USACE and will comply with the existing UDOT individual stormwater permit. The exact types of stormwater treatment system that will ultimately be installed as part of this project will not be determined until final roadway design. The design-build contractor will be responsible for determining final selection of water quality treatments. Long-term maintenance of these water quality treatment features will be performed by UDOT.

For impacted wells located in the limits of disturbance, UDOT will either purchase the groundwater rights from the owner or pay for a transfer of the rights.